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INVESTIGATIONS INTO RISK ASSESSMENT AND COST ANALYSIS AS TOOLS FOR POLLUTION PREVENTION DURING MILITARY EXERCISES AND TRAINING

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ABSTRACT

Military forces are big and diverse organisation with heavy demands for equipment, chemicals and other materials when conducting training, exercises and day to day missions. Military forces are also producers of large quantity of hazardous and harmful wastes, which in the field conditions can have strong negative influence on the environment. Many of these wastes are similar to those of large civilian industrial organisations, but some are peculiar to the army mission.

The main purpose of the presentation is to show ideas developed for estimation of environmental losses and costs resulting from military exercises and training activities of land troops, navy and airforce. The legislative, economic and technical tools, which lead to the minimisation of the environmental damages during the military training and exercises, are discussed. Types of military training activities and materials, which have the most severe environmental impact, have been identified.

Furthermore, the paper describes measures undertaken within the military sector to face the environmental standards and regulations relating to national guidelines on air, water, soil, and nature protection during the military training and exercises.

1. INTRODUCTION

Military forces are big and diverse organisation with heavy demands for equipment, chemicals and other materials when conducting training, exercises and day to day missions. Military forces are also producers of large quantity of hazardous and harmful wastes, which in the field conditions can have strong negative influence on the environment. Many of these wastes are similar to those of large civilian industrial organisations, but some are peculiar to the army mission. For example military forces have major responsibility for energetic materials – propellants and explosives, different kinds of fuels and for NBC training.

The main purpose of the presentation is to show ideas developed for estimation of environmental losses and costs resulting from military exercises and training activities of land troops, navy and airforce.

It is well recognised that military training and exercises performed on different military training areas, facilities and installations results with negative environmental impact.

2. LEGISLATIVE MEASURES

During last ten years the approach of Polish Ministry of Defence to the environmental issues has diametrically changed. Though the activities of Polish Armed Forces in the field of environmental protection have been conducted for more than twenty years nevertheless sometimes they haven't been carried out with full understanding and in the proper way. Today it is fully accepted that military training and exercises have to be conducted with the agreement to the environmental law and with the responsibility for the nature preservation.

Nowadays activities of Ministry of National Defence take place in more restrictive requirements of national and local environmental legislation. Exact execution of the responsibilities of users of environment is controlled by the State Inspectorate of Environmental Protection, which can even stop the exploitation of firing ranges and other military training facilities, which don't fulfil environmental standards. Polish Ecological Law treats the military sector in the same manner as other users of the environment.

The article 5 of the Constitution of the Republic of Poland of 6 April 1997 specifies *"Republic of Poland guards independence and indivisibility of its territory, ensures freedom and human rights and safety to its citizens, guards national heritage and ensure environmental protection, leading by sustainable development principle"*.

In the article 26 the Constitution states *"The Armed Forces of the Republic of Poland serve to protect the independence of the State and the indivisibility of its territory as well as to ensure the security and inviolability of its borders"*.

We see that according to the highest law military activity must always be considered in an ecological context and environmental requirements, whenever it does not weaken military preparedness. Environmental impact of the military training and exercises is not a new matter, however general awareness of significance of the problem is relatively new and it is quite difficult tasks to be fulfilled by Ministry of Defence alone.

Nowadays Polish Ministry of National Defence fully realises the adverse environmental and human health impacts of military activities (training and exercises). Having that in mind, always whenever it does not diminish military performance, military sector complies with all articles of environmental law and regulations established for civilian sector in Poland.

Poland, like the majority of other countries, has extensive and comprehensive environmental legislation, which has evolved over years. Especially, since the United Nations Conference on "Human and Environment" in Stockholm in 1972 and "Environment and Development" called *Earth Summit* in Rio de Janeiro in 1992 have taken place. In accordance with standing legal order in the Republic of Poland, the Armed Forces are subject to all normative regulations universally valid in the State. Moreover, environmental liability refers both to military organisations and to personal liability of the commanders, at all levels of command.

The Act on Protection and Shaping of the Environment of 31 January 1980 in article No 89 impose normative obligation to ensure conditions that are vital to accomplishment of environmental protection regulations. According to the legislation, Minister of National Defence is obliged to create organisational and legal conditions for complying with environmental protection regulations. Council of Ministers Decree of 9 July 1996 also obliges the Minister of National Defence to ensure the compliance with the requirements of environmental protection within the military sector.

Regulation on environmental protection in military sector of 1975 issued by the Minister of National Defence concerned planning period of 1975-1990. Hence three five-year plans had been developed, approved and implemented up to 1990. In Poland primary act on environmental issues is already mentioned *Act on Protection and Shaping of the Environment* of 1980 amended in 1994. The Resolution of the Polish Parliament on the *State Ecological Policy* of 1991 was also a milestone event in evolving the process of Polish environmental legislation.

As far as environmentally related legislation in Poland is concerned, Polish Armed Forces should accomplish all principles and rules like any other governmental or commercial civilian organisations do.

Polish Armed Forces, as crucial for successful environmental performance, have identified following areas:

- environmental risk assessment on each military installations;
- remediation of polluted areas;
- ecological education of both military and civil staff;
- environmental audits carried out in all of the military organisational units;
- provide conditions to assure environmental and health safety
- creation new financing sources and instruments for environmental performance in military sector;
- reduction adverse environmental impact of military training and exercises;
- creation of ecological data base necessary for conducting processes of command, planning, and executing of the tasks

Successful meeting of environmental requirements needs adequate legal procedures to assure effective inspection of compliance with environmentally relevant legislation on military training areas and installations. This issue is regulated by the *Act on State Inspection of the Environmental Protection* of 1991 (PIOŚ) and Minister of National Defence *Decision of 1996 on circumstances of render military installations availability to State Inspectors*.

In 1997 Minister of National Defence and Minister of Environmental Protection Natural Resources and Forestry signed an agreement, on co-operation in the field of environmental protection. The agreement is expected to create new financial instruments for environmental projects undertaking in the military training areas, firing ranges and other facilities. There are also provided conditions for use of forestry areas for military training and other defence-related purposes.

3. POLISH ARMED FORCES AS THE USER OF THE ENVIRONMENT

Armed Forces, due to its peculiarity and carried-out tasks, use the environment within two aspects, which result in contamination, damage and emission of pollution. Firstly, the armed forces use the environment to support its primary military mission. Secondly, military sector, like any other governmental organisation, uses the environment to meet living needs as accommodation, food and welfare facilities.

Successful meeting the primary military mission needs to maintain equipment, store armaments and, first of all, have high skilled soldiers to operate the military equipment. Soldiers must have the opportunity to perform exercise and training in realistic conditions. Armaments and equipment must be tried and tested in the field. Hence training with high concentration of people, equipment and hazardous materials has to have an adverse impact on the environment. The question is how to control the impact, limit it and restore occurred environmental damages.

One of the stipulations of accomplishing of the established aim is the acceptance of the following, main environmental protection principles within the training activities of the Armed Forces:

- organisation of environmental protection is the duty of the commanders at every command level;
- environmental protection is the obligation of each soldier and employees of the Ministry of National Defence;
- implementation of the principle of reduction of negative influence on environment in the process of training troops, as well as planning and carrying out other defence related tasks;
- ecological education is an integral element of every form of training and education in the Armed Forces;
- rational utilisation of natural resources and reduction of negative effects of troops training and accommodation on the environment.

Military training, technology and equipment causing the necessity to reconcile two contradictory, for the armed forces, tendencies:

- (1) intensification of training troops, especially of combat training, by making its conditions similar to the real ones and taking advantage of all the possible means of simulating;
- (2) ensuring the protection of forests, soil, air, water and plants from pollution and damage caused by training activity.

There is a wide range of military training activities having adverse impact on the environment. The Ministry of National Defence in Poland identified following military facilities and areas of significant environmental influence:

- operational and reserve airfields;
- fuel storage depots and pipelines;
- naval harbours and radar stations;
- central testing grounds, firing ranges and exercise fields;
- garrison firing ranges and exercise fields;
- ammunition storage facilities;
- operation facilities such as: car and tank washing stands, battery rooms, paint shops, electrovining plants, workshops;
- garrisons with barracks, headquarters and residential areas.

Military sector provides soldiers with means to meet their necessities of live, such as accommodation, food, welfare facilities, recreation. These uses of the environment by military sector create similar environmental problems to that caused by civilian urbanised areas.

Finally, speaking about the Armed Forces as a user of the environment we must remember that military sector has not only adverse impact to the environment. Despite the military exercises the training grounds of Polish Armed Forces and, in particular, the large troop training grounds are known as very well preserved areas with unique flora and fauna. A number of threatened animals and plants have found their habitation on desert areas controlled by the armed forces. In general it can be stated that the last or even larger local populations of animal and plant species which have otherwise disappeared, or which become extremely rare exist on military training areas. The numerous and valuable biotopes which can be found on our military training grounds are a clear indication that military occupancy and nature conservation have not to be incompatible.

4. REDUCTION OF ADVERSE ENVIRONMENTAL IMPACT OF MILITARY TRAINING AND EXERCISES

The basic objective of environmental protection in the Armed Forces is to ensure ecologically safe conditions during carrying out defence related tasks. The way to accomplish this objective is the implementation of the main principles of environmental protection, as well as realisation of pro-ecological tasks by all of those in the Armed Forces, who use the environment both militarily and economically.

Only limited works has yet been undertaken at Armed Forces sites to register and assess contamination of soil and groundwater. Surveys of petroleum products storage depots indicated that only few of the them were equipped with basic spill emergency facilities. Moreover, approximately 40% of petrol, oil and lubricants distribution facilities have been more than 30 years without any protection measure. As a consequence, investigations at sites (in particular airfields) showed the presence of contamination of both soil and water environment with fuel and lubricants.

The other source of soil and water contamination is wastewater generated at military sites. About 6% of sewage volume are discharged to so-called "Dumping grounds" without prior treatment. Significant amounts of poorly treated wastewater are discharged into surface water resulting in degradation of their quality.

Recent surveys and inspections of storage areas and areas where hazardous substances are used or handled indicated neither any violation of Polish environment protection regulations nor threat to people or the environment.

The following actions are planned or have been already undertaken in order to prevent further soil and water at military training areas in Poland:

- Installation of leakage monitoring systems at fuel and chemicals storage depots;
- Replacement of disused storage tanks and distribution facilities;
- Sealing handling areas of petroleum products;
- Installation of anti-oil dams, bilge water and sewage collection systems at naval bases;
- Safe processing of hazardous solid wastes;
- Recycling of used equipment and materials;
- Organisation of a monitoring network based on automatic contamination measurements, data transmission and processing;
- Forestation and reforestation by trees and shrubs planting.

Remedial action has mainly been limited to installing measures, which stop spreading the pollution and prevent future damage. Projects related to the decontamination of polluted in the past soil or groundwater have virtually not been undertaken except for emergency situations such as uncontrolled spills in areas of utilised groundwater resources, as – for example – it was the case at the Pila airfield, where jet fuel had spilled.

Environmental performance in the Polish Armed Forces is recognised as a priority and has been included into the “Project on Modernisation of the Armed Forces in 1998-2012” accepted by the Government. Budget of Ministry of National Defence destines 180 millions zloty for implementation of environmental projects in the field of military infrastructure, including general infrastructure, airfields, naval, transportation, training and special infrastructure. Additional funds are expected from the National Fund for Environmental Protection and Water Management of 30 millions zloty in the period of 1998-2002 and 60 millions zloty in 2003 - 2012 years.

Polish Armed Forces developed following projects to accomplish targets and priorities established by the State Ecological Policy of 1991:

A. Project on energy save in military installation by the year 2000

It is assumed as target substantial reduction of energy consumption by approximately 25 to 30%. What in consequence should result in the reduction of fuels consumption and carbon dioxide emission by approximately 20 to 25%.

Such results will be achieved by:

- Thermal upgrading of the buildings;
- Replacement of the heating network with pre-insulated pipes;
- Retro-fitting of the coal fuelled boilers;
- Liquidation of small boilers which through outdated technology are hazardous to the environment.

B. Project on improvement of maintain and operation facilities.

This project defines scope of necessary repair and retro-fitting work at the car and tank wash stands, battery and painting plants, galvanising and oxidising plants, so it will be possible for these facilities to achieve environmental protection requirements. It is very important because of necessity improving low technical condition of these facilities, which harmful influence to the environment is serious. For example 3 years ago over 40% of lead battery plants didn't meet the basic requirements of environmental protection.

C. Pilot project on environmental protection planning and management of training areas.

It is expected that outcomes from the pilot project on environmental protection planning and management of training areas. The result of the project will become a base to formulate detail orders for carrying out military exercises on all training areas in a way that ensure accomplishment of environmental requirements and sustain use of the training area. The pilot project consists of three stages, as following:

- preparing documentation about the state of the environment and inventory of existing facilities both military and civilian;
- developing of concept of further use of the training areas in the coming 20 years, which would fully satisfy military performance and meet environmental requirements and standards;
- analysis of obtained data will help in elaboration an order on environmental protection precaution at the training area.

D. Project on fuel and grease storage areas (in the period of 1996-2000).

During the realisation of that project we assume remediation of contaminated soil and ground water and elimination sources of contamination. After the first research stage of that project we spent approximately 1.5 mil. USD. Expenses connected with remediation of airfields are difficult to estimate in, and they are still analysing.

E. Project for protection against the noise on airfields

Realisation of that project is based on the study and implementation of systems reducing the level of noise in the areas of airfields. So far it was elaborated and implemented such a project for one airfield, and for the next two there is in the course of work.

5. EDUCATION

Successful implementation of the environmental program in the Polish Armed Forces is strongly dependent upon a well-qualified workforce. For this purpose we established program and system of ecological education and training. This system covers every segment of the Armed Forces at all levels from the top commanders to each soldier. Ecological education in the Ministry of National Defence is based on the military command and control system and is a part of entire education system of all officers and soldiers.

Everyone in the military must be aware of his/her ecological responsibility and take action in case of necessity. Our goal is, that each member of the military society should be trained so that he/she can meet the environmental responsibilities associated with his/her job and activity. The program is based on different levels of education: recruit training, special training, professional military education, continuing education for environmental professionals and education of senior leadership. Each soldier is obliged to attend 20 hours courses of environmental education. Last year the Ministry of National Defence has issued one thousand of posters and ten thousands of brochures devoted to the environment protection. Further 60 thousands brochures will be issued this year. The modern environmental handbook for Armed Forces will be issued by the end of this year.

Postgraduate education and training courses for civilian and for commissioned officers have been conducted at Military University of Technology (since 1988), at The National Defence Academy (since 1992) and at the civilian Main School of Farming in Warsaw (since 1992). Altogether more than eight hundred specialists have completed these post-graduated studies. A number of specialists have successfully completed environmental courses at the NATO school in Oberammergau.

6. RESEARCH AND DEVELOPMENT

The huge amount of ecological tasks in Armed Forces needs developing new branches of knowledge and new technologies. The military sector is seeking for alternative materials and technologies that meet performance requirements specific to the military activities, with less adverse environmental impact than materials and technologies currently in use.

On the other side the problem of safe disposal the old military equipment and munitions, acid battery, used oil and chemicals, as well as remediation of contaminated soil and groundwater need new, cost effective and socially acceptable processes and technologies.

Ministry of National Defence and the Scientific Research Committee arranges financial support for developing modern technologies and techniques including those for soil and groundwater remediation. A number of new material technologies and remediation techniques are now being tested at a laboratory and pilot scale.

For example, the following environmental-related technologies and techniques have been recently tested:

- Application of surfactants for washing of contaminated soil;
- Removal of hydrocarbons from contaminated soil by means of desorption;
- Groundwater decontamination by physicochemical method
- Noise reduction system;
- New simulation and training technology;
- Reduction of fuel consumption and lowering toxic emission;
- Development of advanced and environmentally friendly materials.

However, in Poland is still a significant demand for new technologies and remediation techniques. Implementation of new, environmental friendly, technologies and techniques has not only positive ecological aspect but also positive economic effect.

7. CONCLUSIONS

Military training and exercise should always be considered in an ecological context. Environmental protection is not a primary task of the Polish Armed Forces and neither it will be, but the Polish Armed Forces are ready to assist in conserving the environment in their own sphere and to avert dangers to the environment outside of the armed force.

We believe, that the implementation the environmental friendly means during the training activity will result with the reduction of negative environmental impact of troops training on air, soil, forests, ground water, and surface water and thereby will reduce costs of military training. The way to accomplish these objectives is the implementation of the main principles of environmental protection, as well as realisation of pro-ecological tasks by all of those in the armed forces, who use the environment both militarily and economically.